13:41:52 OCA PAD AMENDMENT - PROJECT HEADER INFORMATION 05/18/93

Active

Project #: E-20-G25 Cost share #: Rev #: 3
Center # : 10/24-6-R7382-0A0 Center shr #: OCA file #:
Work type : RES
Contract#: MSS-9196243 Mod #: AMEND 01 Document : GRANT
Prime #: Contract entity: GTRC

Subprojects ? : N CFDA: 47.041
Main project #: PE #:

Project unit: CIVIL ENGR Unit code: 02.010.116
Project director(s):
CHAMEAU J L CIVIL ENGR

Sponsor/division names: NATL SCIENCE FOUNDATION / GENERAL
Sponsor/division codes: 107 / 000

Award period: 910930 to 940131 (performance) 940430 (reports)

Sponsor amount	New this change	Total to date
Contract value	0.00	89,800.00
Funded	0.00	89,800.00
Cost sharing amount		0.00

Does subcontracting plan apply ?: N

Title: UNDISTURBED SAMPLING BY CHEMICAL IMPREGNATION

PROJECT ADMINISTRATION DATA

OCA contact: Jacquelyn L. Tyndall 894-4820

Sponsor technical contact	Sponsor issuing office
ELBERT MARSH	H. D. WOLFE
(000)000-0000	(000)000-0000
NATIONAL SCIENCE FOUNDATION	NATIONAL SCIENCE FOUNDATION
1800 G STREET, NW	1800 G STREET, NW
WASHINGTON, DC 20550	WASHINGTON, DC 20550

Security class (U,C,S,TS) : U ONR resident rep. is ACO (Y/N): N
Defense priority rating : supplemental sheet
Equipment title vests with: Sponsor GIT X

Administrative comments -
AMENDMENT 01 EXTENDS PROJECT TERMINATION DATE TO JANUARY 31, 1994. FINAL REPORT DUE APRIL 30, 1994.

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

NOTICE OF PROJECT CLOSEOUT

Closeout Notice Date 04/26/94

Project No. E-20-G25 Center No. 10/24-6-R7382-0A0

Project Director CHAMEAU J L School/Lab CIVIL ENGR

Sponsor NATL SCIENCE FOUNDATION/GENERAL

Contract/Grant No. MSS-9196243 Contract Entity GTRC

Prime Contract No.

Title UNDISTURBED SAMPLING BY CHEMICAL IMPREGNATION

Effective Completion Date 940131 (Performance) 940430 (Reports)

Closeout Actions Required:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	N	
Final Report of Inventions and/or Subcontracts	N	
Government Property Inventory & Related Certificate	N	
Classified Material Certificate	N	
Release and Assignment	N	
Other	N	

CommentsLETTER OF CREDIT APPLIES. 98A SATISFIES PATENT REQUIREMENT.

Subproject Under Main Project No.

Continues Project No.

Distribution Required:

Project Director	Y
Administrative Network Representative	Y
GTRI Accounting/Grants and Contracts	Y
Procurement/Supply Services	Y
Research Property Managment	Y
Research Security Services	N
Reports Coordinator (OCA)	Y
GTRC	Y
Project File	Y
Other	N
	N

OMB Number 3145-0058

NATIONAL SCIENCE FOUNDATION
1800 G STREET, NW
WASHINGTON, DC 20550

PI/PD Name and Address

Jean-Lou A. Chameau
School of Civil Engineering
GA Tech Res Corp - GIT
790 Atlantic Drive
Atlanta GA 30332-0355

NATIONAL SCIENCE FOUNDATION
FINAL PROJECT REPORT

PART I - PROJECT IDENTIFICATION INFORMATION

1. Program Official/Org.	MEHMET T. TUMAY - CMS
2. Program Name	STRUCTURES, GEOMECHANICS & BLDG SYSTEMS
3. Award Dates (MM/YY)	From: 9/91 To: 01/94
4. Institution and Address	GA Tech Res Corp - GIT Administration Building Atlanta GA 30332
5. Award Number	[illegible]
6. Project Title	Urethane Foam Sampling by Chemical Impregnation

This Packet Contains
NSF Form 98A
And 1 Return Envelope

Undisturbed Sampling by Chemical Impregnation

NSF Research Grant No. MSS-9196243

SUMMARY OF MAIN ACCOMPLISHMENTS

Demonstration of agar use under field conditions. An innovative sampling device was developed for *in situ* impregnation and sampling of the San Francisco Bay sand fills. The device consisted of a conventional piston sampler retrofitted with an additional outer shell around the sampler to provide an annular space for placement of a heat coil and to permit radial injection of agar impregnate into samples at the bottom of a boring. Related innovations included development of the equipment required on the ground surface and between the surface and sampler to permit *in situ* impregnation using the piston sampler. The device was successfully used for sampling of the referenced sand fills both above and below the ground water table.

Identification of agarose as a more desirable impregnate over agar. As outlined by previous research on agar impregnation (Schneider, 1985), the gelling and gel melting characteristics of agar, while being the best available at the time, were not optimum for the proposed sampling with minimum disturbance. Specifically, both the gelling (60°C) and gel melting (90°C) temperatures were relatively high, increasing the risk of soil disturbance due to heating alone. During this project, a search for a more suitable impregnate concluded with selection of agarose as an impregnate with more desirable impregnate properties. Agarose is a derivative of agar which is used in DNA research and for laboratory microsieving. Various types of agarose are now commercially available with differing strengths, and gelling/gel melting temperatures. For this research, an agarose with a gel strength higher than agar and with lower gelling (28°C) and gel melting (65°C) temperatures was selected.

Development of an agar/agarose impregnate removal and triaxial testing system. A simple prototype of an agar/agarose impregnate removal system was developed to permit specimen trimming, confinement, impregnate removal and triaxial testing of specimens collected in the field. This system was used in the project for agarose removal from specimens impregnated in a chamber constructed to simulate *in situ* impregnation. The system was also used for studying the effects of heating, impregnation and impregnate removal from triaxial specimens.

Demonstration that agarose impregnation has little to no effect on cyclic mobility and drained monotonic behavior. The project studied the effects of drained heating, impregnation and impregnate removal on the monotonic and cyclic behavior of clean sands. Two sands (Ottawa F-125 modified for an 80-200 blend and Ottawa 20-30) at several relative densities were subjected to cyclic mobility testing both with and without agarose impregnation to study the effect of agarose impregnation on the cyclic mobility behavior. The results indicated little to no significant effect of agarose impregnation on cyclic mobility. Drained monotonic triaxial tests were performed on Ottawa 20-30 sand and while there was no significant effect on the stress-strain behavior, a possible slight effect was indicated in the dilation of the specimens. Further investigation of this possible effect was recommended for future research.

Demonstration of a self boring impregnation device in a laboratory testing chamber. A series of tests were performed to simulate *in situ* impregnation in a large tank filled with clean Valdosta 16-40 sand at several relative densities. The impregnation was performed using a heated impregnation pipe to simulate a self boring *in situ* impregnation tool. These tests demonstrated that an approximately 1 foot diameter bulb of agarose impregnated soil could be formed in clean sands below the water table. After impregnation, the bulbs were hand excavated, quartered, and trimmed into cylindrical specimens for triaxial testing. The drained triaxial tests indicated consistent void ratios and similar stress-strain and dilatancy behavior for the four specimens from any given bulb. The results suggested that even if some disturbance occurs due placement of the impregnation tool and sampling, the disturbance could be consistent and quantifiable for a given deposit. The testing also showed the stability of agarose impregnated sands in unconfined conditions and the practicality of trimming and mounting agarose impregnated sands.

Undisturbed Sampling by Chemical Impregnation

NSF Research Grant No. MSS-9196243

PUBLICATIONS

Publications already in print (copies enclosed)

Sutterer, Kevin G. (1993). "Undisturbed Sampling of Cohesionless Soils using Polymer Impregnation." Ph.D. thesis, Georgia Institute of Technology, 213 pages.

Sutterer, K., Chameau, J.-L., and Frost, J.D. (1994). "Sampling of Granular Soils using a Polymer." Vol. VI, Proc. XIII International Conference on Soil Mechanics and Foundation Engineering, New Delhi, India.

Planned Publications

Sutterer, K. G., Chameau, J.-L., and Frost, J.D. "The Effects of Agarose Impregnation on the Monotonic and Cyclic Behavior of Clean Sands." Under preparation for submittal to ASTM Geotechnical Testing Journal in April 1994.

Sutterer, K.G., Chameau, J.-L., and Frost, J.D. "A Self-Boring Agarose Impregnation Device to Assist Undisturbed Sampling of Cohesionless Soils." Planned submittal to ASTM Geotechnical Testing Journal in the Fall of 1994.

PART IV -- FINAL PROJECT REPORT -- SUMMARY DATA ON PROJECT PERSONNEL

(To be submitted to cognizant Program Officer upon completion of project)

The data requested below are important for the development of a statistical profile on the personnel supported by Federal grants. The information on this part is solicited in resonse to Public Law 99-383 and 42 USC 1885C. All information provided will be treated as confidential and will be safeguarded in accordance with the provisions of the Privacy Act of 1974. You should submit a single copy of this part with each final project report. However, submission of the requested information is not mandatory and is not a precondition of future award(s). Check the "Decline to Provide Information" box below if you do not wish to provide the nformation.

Please enter the numbers of individuals supported under this grant.
Do not enter information for individuals working less than 40 hours in any calendar year.

	Senior Staff		Post-Doctorals		Graduate Students		Under-Graduates		Other Participants[1]	
	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.
A. Total, U.S. Citizens	1				1					
B. Total, Permanent Residents	2									
U.S. Citizens or Permanent Residents[2]:										
American Indian or Alaskan Native										
Asian.....										
Black, Not of Hispanic Origin.....										
Hispanic										
Pacific Islander										
White, Not of Hispanic Origin	3				1					
C. Total, Other Non-U.S. Citizens										
Specify Country 1.										
2.										
3.										
D. Total, All participants (A + B + C)	3				1					
Disabled[3]										

☐ Decline to Provide Information: Check box if you do not wish to provide this information (you are still required to return this page along with Parts I-III).

[1] Category includes, for example, college and precollege teachers, conference and workshop participants.

[2] Use the category that best describes the ethnic/racial status fo all U.S. Citizens and Non-citizens with Permanent Residency. *(If more than one category applies, use the one category that most closely reflects the person's recognition in the community.)*

[3] A person having a physical or mental impairment that substantially limits one or more major ife activities; who has a record of such impairment; or who is regarded as having such impairment. *(Disabled individuals also should be counted under the appropriate ethnic/racial group unless they are classified as "Other Non-U.S. Citizens.")*

AMERICAN INDIAN OR ALASKAN NATIVE: A person having origins in any of the original peoples of North America and who maintains cultural identification through tribal affiliation or community recognition.

ASIAN: A person having origins in any of the original peoples of East Asia, Southeast Asia or the Indian subcontinent. This area includes, for example, China, India, Indonesia, Japan, Korea and Vietnam.

BLACK, NOT OF HISPANIC ORIGIN: A person having origins in any of the black racial groups of Africa.

HISPANIC: A person of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish culture or origin, regardless of race.

PACIFIC ISLANDER: A person having origins in any of the original peoples of Hawaii; the U.S. Pacific territories of Guam, American Samoa, and the Northern Marinas; the U.S. Trust Territory of Palau; the islands of Micronesia and Melanesia; or the Philippines.

WHITE, NOT OF HISPANIC ORIGIN: A person having origins in any of the original peoples of Europe, North Africa, or the Middle East.